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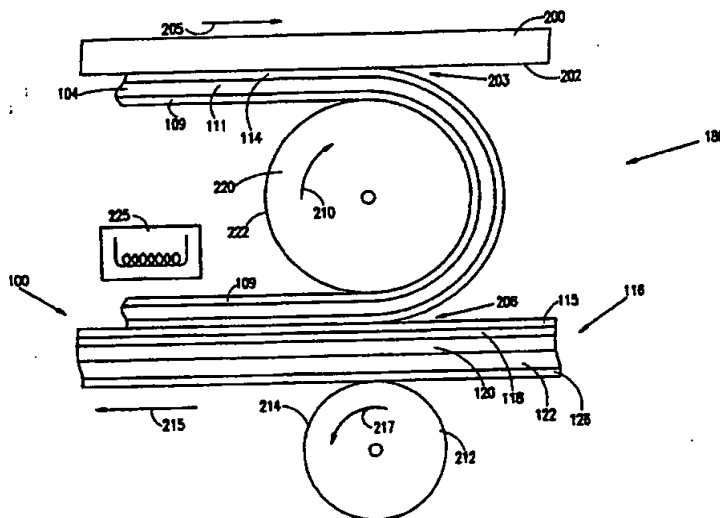
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(54) Title: INTERMEDIATE TRANSFER BLANKET AND METHOD OF PRODUCING THE SAME



(57) Abstract

A multi-layered image transfer blanket (100) and a method of producing same, including a body portion (116) and an image transfer portion (104), the image transfer portion (104) having an image transfer surface and a back surface, comprising forming the image transfer portion (104) on a carrier substrate (200) and transferring the image transfer portion onto the body portion (116) such that the back surface of the image transfer portion faces the body portion. Preferably, the image transfer portion is formed on the carrier substrate such that the back surface of the image transfer portion faces the carrier substrate.

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1 INTERMEDIATE TRANSFER BLANKET AND METHOD OF PRODUCING THE SAME  
2

3 FIELD OF THE INVENTION

4 The present invention relates to improved intermediate  
5 transfer blankets, especially suited for transfer of liquid  
6 toner images, and methods of producing such blankets.

7  
8 BACKGROUND OF THE INVENTION

9 The use of an intermediate transfer member in  
10 electrostatic imaging is well known.

11 Various types of intermediate transfer members are known  
12 and are described, for example in U.S. Patents 3,862,848,  
13 4,684,238, 4,690,539 and 4,531,825, the specifications of all  
14 of which are incorporated herein by reference.

15 Belt-type intermediate transfer members for use in  
16 electrophotography are known in the art and are described,  
17 inter alia, in U.S. Patents 3,893,761, 4,684,238 and  
18 4,690,539, the specifications of all of which are incorporated  
19 herein by reference.

20 The use of intermediate transfer members and members  
21 including transfer blankets, for offset ink printing, is also  
22 well known. Such blankets have characteristics which are  
23 suitable for ink transfer but they are generally not usable,  
24 per se, for liquid toner imaging.

25 Multi-layered intermediate transfer blankets for toner  
26 imaging are known in the art. Generally, such blankets include  
27 a thin, multi-layered, image transfer portion and a base (or  
28 body) portion which supports the image transfer portion and  
29 provides the blanket with resilience during contact with an  
30 imaging surface and/or a final substrate. While the process  
31 for producing the image transfer portion is a relatively clean  
32 process, the base portion is generally not compatible with  
33 such clean processes.

34 Mechanisms for continuous replacement of an imaging  
35 blanket are known in the art. Such a mechanism is described,  
36 for example in Japanese Publication JP 5046037, published  
37 February 26, 1993, wherein a continuous sheet of transfer-  
38 blanket material is rolled-up in a cassette, inside a drum,

1 and a premeasured length of the blanket material is stretched  
2 circumferentially on the surface of the drum. When the  
3 stretched out length of blanket requires replacement, the used  
4 portion of the blanket is drawn into a take-up cassette,  
5 inside the drum, and a new portion of the blanket is stretched  
6 between the two cassettes. It should be noted that the length  
7 of transfer-blanket material in the cassettes is limited by  
8 the thickness of the continuous blanket and the available  
9 space within the drum.

10 US patent 4,074,001 describes a fixing roller for  
11 electrophotography which has a 3 mm coating of a mixture of  
12 diorganopolysiloxanes terminated at both chain ends with  
13 diorganohydroxysilyl groups bonded to terminal silicone atoms  
14 (a condensation type silicone), diorganopolysiloxanes  
15 terminated at both chain ends with trialkylsilyl groups (a  
16 substantially unreactive silicone oil), a minor part of an  
17 alkoxysilane catalyst and various amounts of fillers. This  
18 material vulcanizes, in the 3 mm thickness, at room  
19 temperature.

20 SUMMARY OF THE INVENTION

21 It is an object of an aspect of the present invention to  
22 provide an improved image transfer blanket for use as part of  
23 an image transfer member in imaging apparatus, especially in  
24 image forming apparatus using electrostatically charged toner.

25 It is an object of an aspect of the present invention to  
26 provide an improved method and apparatus for producing a  
27 multi-layered image transfer blanket.

28 It is an object of an aspect of the present invention to  
29 provide an image transfer blanket having a base portion and an  
30 image transfer portion, wherein the image transfer portion is  
31 movable relative to the base portion.

32 It is an object of an aspect of the present invention to  
33 provide a mechanism for replacing the image transfer portion  
34 of the image transfer blanket without replacing the base  
35 portion of the blanket.

36 It is a further object of some aspects of the invention  
37 to provide an improved release layer for intermediate transfer  
38 members and blankets.

1        There is thus provided, in accordance with a preferred  
2 embodiment of the invention, a method of producing a multi-  
3 layered image transfer blanket including a body portion and an  
4 image transfer portion, the image transfer portion having an  
5 image transfer surface and a back surface, comprising:

6        forming the image transfer portion on a carrier  
7 substrate; and

8        transferring the image transfer portion onto the body  
9 portion such that the back surface of the image transfer  
10 portion faces the body portion.

11       Preferably the image transfer portion is formed on the  
12 carrier substrate such that the back surface of the image  
13 transfer portion faces the carrier substrate.

14       In a preferred embodiment of the invention transferring  
15 the image transfer portion comprises:

16       transferring the image transfer portion to a moving  
17 carrier surface, such that at least a portion of the image  
18 transfer surface is in contact with the moving surface; and

19       laminating the image transfer portion onto the body  
20 portion such that the back surface of the image transfer  
21 portion faces the body portion.

22       Preferably the method comprises curing at least one of  
23 the layers in said multi-layered blanket after transferring  
24 the image transfer portion. Preferably, the image transfer  
25 blanket comprises a polymer layer, preferably a conducting  
26 layer, interfacing the back surface of the image transfer  
27 portion and curing at least one of the layers comprises curing  
28 the polymer layer after laminating the image transfer portion  
29 onto the body portion.

30       In one preferred embodiment of the invention the polymer  
31 layer is part of the body portion. Additionally or  
32 alternatively, the polymer layer is part of the image transfer  
33 portion.

34       In a preferred embodiment of the invention the image  
35 transfer portion comprises a release layer at the image  
36 transfer surface and a conforming layer and wherein curing at  
37 least one layer comprises curing the release layer and the  
38 conforming layer before laminating the image transfer portion

1 to the body portion. In an alternative preferred embodiment of  
2 the invention the release layer and the conforming layer are  
3 cured after laminating the image transfer portion to the body  
4 portion.

5 In a preferred embodiment of the invention forming the  
6 image transfer portion comprises coating the carrier substrate  
7 with a conforming layer.

8 In a preferred embodiment of the invention forming the  
9 image transfer portion comprises coating the carrier substrate  
10 with a barrier layer.

11 In a preferred embodiment of the invention forming the  
12 image transfer portion comprises coating the carrier substrate  
13 with a conductive layer.

14 In a preferred embodiment of the invention the conforming  
15 layer comprises a plurality of layers of different hardnesses.

16 In a preferred embodiment of the invention forming the  
17 image transfer portion comprises overcoating the conforming  
18 layer with a release layer, preferably comprising a layer of  
19 condensation type silicone.

20 There is further provided in accordance with a preferred  
21 embodiment of the invention an image transfer member suitable  
22 for the transfer of toner images and having an outer release  
23 coating of a condensation type silicone.

24 Preferably the release layer has a thickness of less than  
25 1 mm, more preferably less than 500 micrometers, even more  
26 preferably less than 100 micrometers and most preferably  
27 between 3 and 15 micrometers thick.

28 Further, the release layer preferably has less than 4%  
29 filler, more preferably less than 1% filler, even more  
30 preferably less than 0.1% filler.

31 In a preferred embodiment of the invention the outer  
32 release layer contains less than 10% silicone oil, more  
33 preferably less than 5% silicone oil, more preferably less  
34 than 1% silicone oil, most preferably little or no silicone  
35 oil.

36 In a preferred embodiment of the invention the outer  
37 release layer contains added crosslinker.

1 In a preferred embodiment of the invention the outer  
2 release layer contains added catalyst.

3 In a preferred embodiment of the invention the outer  
4 release layer contains added conductive material.

5 In a preferred embodiment of the invention adhesion of  
6 the outer release coating to the image transfer member is  
7 enhanced utilizing primer.

8 There is further provided, in accordance with a preferred  
9 embodiment of the invention, apparatus for producing a multi-  
10 layered image transfer blanket including a body portion and an  
11 image transfer portion, the image transfer portion having an  
12 image transfer surface and a back surface, comprising:

13 a carrier substrate having the image transfer portion  
14 formed thereon such that the back surface of the image  
15 transfer portion faces the carrier substrate and is releasable  
16 therefrom; and

17 a moving carrier surface, in contact with a portion of  
18 the image transfer surface, which receives the image transfer  
19 portion from the carrier substrate, at a first transfer  
20 region, and laminates the image transfer portion onto the body  
21 portion, at a second transfer region, with the back surface of  
22 the image transfer portion facing the body portion.

23 Preferably, the apparatus further comprises a curing  
24 device which cures at least one of the layers in said multi-  
25 layered blanket.

26 There is further provided, in accordance with a preferred  
27 embodiment of the invention, an image transfer blanket  
28 comprising:

29 a transfer surface adapted to receive already formed  
30 images; and

31 a conforming layer substantially immediately beneath the  
32 release surface which comprises a plurality of sub-layers each  
33 having a Shore A hardness of less than 80, preferably less  
34 than 70, more preferably less than 60.

35 Preferably, the sub-layers comprise at least two sub-  
36 layers, a relatively harder one of said sub-layers being  
37 situated between is between the release surface and a  
38 relatively softer one of said sub-layers. Preferably, the

1 relatively softer sub-layer has a Shore A hardness of less  
2 than 42, less than 35, or less than 25. Preferably, the  
3 relatively harder sub-layer has a Shore A hardness of greater  
4 than 42, or greater than 50. In some preferred embodiments of  
5 the invention the ratio of the thickness of the relatively  
6 harder sub-layer to the thickness of the relatively softer  
7 sub-layer is about 1:4.

8 There is further provided an image transfer blanket  
9 comprising:

10 a body portion including a layer of resilient material;  
11 and

12 a multi-layered transfer portion having an image transfer  
13 surface and including a supporting base layer which is formed  
14 of a substantially non-compliant material,

15 wherein the supporting base layer of the transfer portion  
16 interfaces the body portion.

17 There is further provided in accordance with a preferred  
18 embodiment of the invention a method of producing a multi-  
19 layered image transfer blanket comprising:

20 forming a multi-layered image transfer portion having an  
21 image transfer surface and a supporting base layer, the base  
22 layer being formed of a substantially non-compliant material;  
23 and

24 attaching the image transfer portion to a body portion  
25 including a layer of substantially resilient material,

26 wherein the supporting base layer of the transfer portion  
27 interfaces the body portion.

28 There is further provided, in accordance with a preferred  
29 embodiment of the invention an intermediate transfer member,  
30 which receives a toner image from an imaging surface and from  
31 which it is subsequently transferred, comprising:

32 a drum; and

33 an image transfer blanket mounted on the drum, the image  
34 transfer blanket comprising:

35 a body portion including a layer of resilient material;  
36 and

37 a multi-layered transfer portion having an image transfer  
38 surface which receives the toner image and a supporting base



1 layer which is formed of a substantially non-compliant  
2 material,

3 wherein the supporting base layer of the transfer portion  
4 interfaces the body portion.

5 Preferably, the supporting base layer comprises a layer  
6 of Kapton.

7 There is further provided an intermediate transfer  
8 member, which receives a toner image from an imaging surface  
9 and from which it is subsequently transferred, comprising:

10 a drum;

11 a resilient blanket body mounted circumferentially on the  
12 surface of the drum and having a functional length;

13 a sheet of image transfer material having first and  
14 second ends and having a length equal to at least twice the  
15 functional length of the blanket body;

16 a transfer material supply member associated with the  
17 first end of the sheet; and

18 a transfer material take-up member associated with the  
19 second end of the sheet,

20 wherein an appropriate length of the sheet is stretched  
21 between the supply member and the take-up member, over the  
22 functional length of the blanket body.

23 Preferably, a predetermined length of used-up sheet is  
24 taken-up by the take-up member and replaced with approximately  
25 the same length of unused sheet which is supplied the supply  
26 member.

27 There is further provided a carrier substrate having  
28 formed thereon a multi-layered image transfer arrangement, the  
29 image transfer arrangement comprising a back surface and an  
30 image transfer surface, wherein the back surface of the image  
31 transfer arrangement faces the carrier substrate and is  
32 removably attached thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

1  
2 The present invention will be understood and appreciated  
3 more fully from the following detailed description, taken in  
4 conjunction with the drawings in which:

5 Fig. 1 is a simplified cross-sectional illustration of an  
6 image transfer member, including a multi-layered image  
7 transfer blanket mounted on a drum, in accordance with a  
8 preferred embodiment of the present invention;

9 Figs. 2A and 2B are respective top and side views of the  
10 image transfer blanket of Fig. 1, in accordance with a  
11 preferred embodiment of the present invention;

12 Fig. 2C shows details of the multi-layered construction  
13 of the image transfer blanket of Figs. 2A and 2B, in  
14 accordance with one, preferred, embodiment of the present  
15 invention;

16 Fig. 3 is a schematic illustration of apparatus for  
17 producing a multi-layered image transfer blanket, constructed  
18 and operative in accordance with a preferred embodiment of the  
19 present invention;

20 Fig. 4 is a simplified, schematic illustration of an  
21 image transfer blanket having an image transfer portion,  
22 constructed in accordance with another, preferred, embodiment  
23 of the present invention; and

24 Fig. 5 is a simplified cross-sectional illustration of an  
25 image transfer member, including the image transfer blanket of  
26 Fig. 4 mounted on a drum and apparatus for renewing the image  
27 transfer portion of the image transfer blanket, constructed  
28 and operative in accordance with a preferred embodiment of the  
29 invention.

1           DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

2           Reference is now made to Fig. 1 which is a simplified  
3 cross-sectional illustration of an image transfer member 30,  
4 including a multi-layered image transfer blanket 100 mounted  
5 on a drum 102, in accordance with a preferred embodiment of  
6 the present invention. Image transfer member 30 may, for some  
7 embodiments of the invention, be any suitable intermediate  
8 transfer member having a multilayered transfer portion such as  
9 those described below or in US Patents 5,089,856 or 5,047,808  
10 or in PCT Application PCT/NL 95/00188, filed June 6, 1995, the  
11 disclosures of which are incorporated herein by reference and  
12 by other structures known in the art. As is known in the art,  
13 member 30 is maintained at a suitable voltage and temperature  
14 for electrostatic transfer of a toner image thereto from an  
15 image bearing surface, such as a photoreceptor surface. The  
16 image is preferably transferred from intermediate transfer  
17 member 30 onto a final substrate (not shown), such as paper,  
18 preferably by heat and pressure. For the preferred toner  
19 described in PCT/NL 95/00188, an image temperature of about  
20 95°C at the inception of fusing is preferred.

21           Certain aspects of the present invention, especially the  
22 manner in which transfer blanket 100 is mounted on drum 102,  
23 are shown and described by way of example only and may vary in  
24 accordance with specific requirements and design  
25 considerations. Other preferred methods of mounting the  
26 transfer blanket on the drum are shown in the aforementioned  
27 application number PCT/NL 95/00188.

28           As known in the art, a plurality of single color images  
29 are preferably sequentially transferred, in mutual alignment,  
30 to the surface of an image transfer portion 104 of image  
31 transfer blanket 100, by sequential imaging cycles. When all  
32 of the desired images have been transferred to image transfer  
33 blanket 100, the complete multi-color image is transferred  
34 from transfer member 30 to the final substrate. Alternatively,  
35 each single color image may be separately transferred to the  
36 substrate via the intermediate transfer member, as known in  
37 the art.

1       Reference is now made to Figs. 2A, 2B and 2C which  
2 schematically illustrate a preferred embodiment of image  
3 transfer blanket 100. As shown most clearly in Fig. 2C, image  
4 transfer portion 104 comprises a release layer 109 which is  
5 outermost on the blanket when it is mounted on drum 102.  
6 Underlying layer 109 is a conforming layer 111 preferably of a  
7 soft elastomer, preferably of polyurethane or acrylic and  
8 preferably having a Shore A hardness of less than about 65,  
9 more preferably, less than about 55, but preferably more than  
10 about 35. A suitable hardness value is between about 42 and  
11 about 45. Alternatively, layer 11 may have sub-layers of  
12 varying hardness, as described below.

13       A thin barrier layer for solvents and/or gases 114 lies  
14 between layer 111 and an underlying conductive layer 115 for  
15 some embodiments of the invention. In general, the order of  
16 layers 114 and 115 may be reversed. Conductive layer 115  
17 overlays a blanket body 116 comprising a top layer 118, a  
18 compressible layer 120 and a fabric layer 122. In a preferred  
19 embodiment of the invention, as described in more detail  
20 below, top layer 118 is conductive and conductive layer 115  
21 may be omitted.

22       Underlying the fabric layer there may be an adhesive  
23 layer 126 which is in contact with drum 102. Alternatively,  
24 layer 126 is a very soft, smooth, layer.

25       Drum 102 is preferably heated by an internal halogen lamp  
26 heater or other heater to aid transfer of the image to the  
27 release layer 109 and therefrom to the final substrate, as is  
28 well known in the art. Other heating methods, or no heating at  
29 all, may also be used in the practice of the invention. The  
30 degree of heating will depend on the characteristics of the  
31 toner and/or ink used in conjunction with the invention.

32       As shown in Figs. 2A and 2B, mounting fitting 106  
33 comprises an elongate electrically conducting bar 108, for  
34 example of a metal such as aluminum, formed with a series of  
35 L-shaped mounting legs 110 (in the form of finger-like  
36 extensions) which are also conducting, preferably of the same  
37 material as bar 108, and preferably formed integrally  
38 therewith. In particular, bar 108 is formed, in one preferred

1 embodiment, with a slot into which the end of layered part of  
2 blanket 100 is inserted. Preferably, the end of the layered  
3 part which is inserted into the mounting bar does not include  
4 release layer 109, conforming layer 111 and barrier layer 114,  
5 whereby conducting layer 115 is exposed and is therefore in  
6 electrical contact with bar 108.

7 Alternatively, if layer 118 is conducting or layer 115 is  
8 made thick enough (preferably more than 40 micrometers thick)  
9 the slot can be formed with sharp internal projections which  
10 pierce the outer layers of the blanket and contact conducting  
11 layer 115 or conducting top layer 118.

12 Optionally, each of the layers beneath conducting layer  
13 115 may be partially conducting (for example, by the addition  
14 of conductive carbon black or metal fibers) and the adhesive  
15 (or very soft and smooth) layer 126 may be conductive, such  
16 that current flows, additionally or alternatively, directly  
17 from the drum surface to the conducting layer. In this case  
18 layer 115 may generally be omitted.

19 Optionally, the conforming layer and/or the release layer  
20 are made somewhat conductive (preferably between  $10^6$  and  $10^{12}$   
21 ohm-cm, more preferably, between  $10^9$  and  $10^{11}$  ohm-cm) by the  
22 addition of carbon black or between 1% and 10% of anti-static  
23 compounds such as CC-42 (Witco).

24 For the purposes of most aspects of the present  
25 invention, the structure and method of attachment of the  
26 blanket to drum 30 is not relevant, *per se*, to the invention.

27 In one preferred embodiment of the invention, fitting 106  
28 is formed of a single sheet of metal, wherein the legs are  
29 partially cut from the metal which is bent into a U-shape to  
30 form the slot into which the layered portion is inserted.  
31 After insertion, the outer walls of the slot are forced  
32 against the layered portion to secure the layered portion in  
33 the slot and, optionally, to pierce the outer surface of the  
34 blanket and contact the conductive layer. The partially cut  
35 out portion is bent to form the mounting legs.

36 In the preferred embodiment of the invention, drum 102 is  
37 maintained at a potential suitable for transferring images to  
38 the intermediate transfer member, for example at a negative

1 voltage of 500 volts, which voltage is applied, via mounting  
2 fitting 106 to conductive layer 115 or 118. Thus, the source  
3 of transfer voltage is very near the outer surface of transfer  
4 portion 104 which allows for a lower transfer potential on the  
5 drum.

6        Apart from differences which will be appreciated from the  
7 descriptions herein, the multi-layered blanket 100 of the  
8 present invention is generally similar to that described in  
9 PCT/NL 95/00188, except for additional preferred embodiments  
10 as described herein. However, the multi-layered blanket of the  
11 present invention is produced by a new process, as described  
12 below.

13        It is appreciated that blanket body 116 includes  
14 components which may contaminate at least some of the layers  
15 in the image transfer portion during production of the  
16 blanket. For example, small particles from blanket body 116,  
17 which is generally formed of relatively unclean materials, may  
18 break off the body portion and contaminate the relatively  
19 clean layers of transfer portion 104. This may result in low  
20 transfer efficiency and poor imaging quality. Therefore, in a  
21 preferred embodiment of the present invention, blanket body  
22 116 and image transfer portion 104 are formed separately. The  
23 separately formed image transfer portion is consequently  
24 laminated onto the blanket body, as described in detail below  
25 with reference to Fig. 3. Conducting layer 115 may be coated  
26 directly on blanket body 116 or laminated thereon together  
27 with the other layers of image transfer portion 104, as  
28 described below. Alternatively, layer 118 is conducting and  
29 layer 115 is omitted. Curing of the different layers in the  
30 multi-layered blanket may be performed before, after or during  
31 lamination of the two portions of the blanket.

32        Reference is now made also to Fig. 3 which schematically  
33 illustrates apparatus 180 for forming multi-layered image  
34 transfer blanket 100, constructed and operative in accordance  
35 with a preferred embodiment of the invention.

36        In a preferred embodiment of the invention, the con-  
37 struction of blanket body 116 is generally similar to that  
38 described in PCT/NL 95/00188. One suitable body is MCC-1129-02

1 manufactured and sold by Reeves SpA, Lodi Vecchio (Milano),  
2 Italy. Other preferred blanket types are described in US  
3 Patents 5,047,808; 4,984,025; 5,335,054 and PCT publications  
4 WO 91/03007; WO 91/14393; WO 90/14619; and WO 90/04216, which  
5 are incorporated herein by reference, and in PCT/NL 95/00188.  
6 Body portion 116 includes fabric layer 122, preferably formed  
7 of woven NOMEX material having a thickness of about 200  
8 micrometers, compressible layer 120, preferably comprising  
9 about 400 micrometers of saturated nitrile rubber loaded with  
10 carbon black to increase its thermal conductivity. Layer 120  
11 preferably contains small voids (about 40 - 60 % by volume)  
12 and top layer 118 is preferably formed of the same material as  
13 the compressible layer, but without voids. Blanket body 116  
14 can be produced using production methods as are generally used  
15 for the production of offset printing blankets for ink offset  
16 printing.

17 Blanket body 116 is preferably sized to a relatively  
18 exact thickness by abrading portions of the surface of top  
19 layer 118. A preferred thickness for the finished body 116 is  
20 about 700 micrometers, although other thicknesses are useful,  
21 depending on the geometry of the printing system in which it  
22 is used and the exact materials used in the blanket body.

23 The fabric side of blanket body 116 may be coated with a  
24 30 micrometer thick coating of silicone based adhesive  
25 (preferably, Type Q2-7566 manufactured by Dow Corning). The  
26 adhesive is covered with a sheet of mylar coated with a  
27 fluorosilicone material, such as DP 5648 Release Paper (one  
28 side coat) distributed by H.P. Smith Inc., Bedford Park, IL.  
29 This adhesive is characterized by its good bond to the surface  
30 of drum 102 and its resistance to the carrier liquid used in  
31 the liquid toner. The blanket may be removed from drum 102,  
32 when its replacement is desired, by cutting the blanket along  
33 the edge of fitting 106 and removing the blanket and fitting.

34 An adhesive is preferably used to assure good thermal  
35 contact between the back of the blanket and the drum on which  
36 it is mounted. A silicone adhesive is preferred since  
37 adhesives normally used in attachment of blankets to drums in  
38 the printing art deteriorate under the heat which is generated

1 in the underlying drum in the preferred apparatus. While the  
2 temperature of the drum varies, depending on the thermal  
3 resistance of the blanket and the desired surface temperature  
4 of the blanket (which in turn depends on the toner used in the  
5 process and the details of transfer of the toner to the final  
6 substrate), the drum temperature may reach 80°C, 100°C, 120°C  
7 or 150°C or more.

8 As an alternative to, or additional to, the adhesive  
9 layer 126, a very soft conforming layer may be used at the  
10 back of the blanket. A soft layer of this type will allow for  
11 good thermal contact between the blanket and the heated drum  
12 102 so that the temperature of the drum need not be excessive  
13 in order for the outer surface of the blanket to reach its  
14 operating temperature. Furthermore, such a soft layer,  
15 especially if it is very soft, will cause the blanket to  
16 "cling" to the drum obviating the use of adhesive under  
17 certain circumstances. Furthermore, when the blanket is  
18 replaced there is no adhesive residue on the drum to be  
19 removed.

20 A very soft layer may be produced by the following  
21 method:

22 1) 100g of Hi-Temp 4051 EP (Zeon) acrylic resin is mixed  
23 with 2g NPC-50 crosslinker (Zeon) and 3g sodium stearate and  
24 dissolved in toluene to give a solution of 15% non-volatile  
25 solids. Optionally, up to about 40g of carbon black Pearls 130  
26 (Cabot) is added.

27 2) A thin layer of the solution is coated onto release  
28 coated mylar and dried. This process is repeated several times  
29 until a thickness of preferably 20-30 micrometers is achieved.

30 3) The uncured resin is laminated to the adhesive layer  
31 of a blanket produced in accordance with the invention, or  
32 directly to the fabric layer. This step is preferably carried  
33 out prior to the cure of the release layer.

34 4) The laminated structure is cured together with the  
35 release layer and the release coated mylar is removed.

36 The very soft conforming layer has a Shore A hardness of  
37 about 20-24 without carbon black and about 40-45 with carbon  
38 black. Softer materials are also suitable; however,



1 substantially harder materials do not adhere well to the drum  
2 surface. Optionally, the trailing end of the blanket is not  
3 coated with the very soft layer. The trailing edge is coated  
4 with an adhesive to improve adhesion between this portion and  
5 the drum or other surface to which it is attached. This is  
6 especially desirable when somewhat harder materials are used  
7 for the very soft layer.

8       The acrylic material may be replaced by other soft  
9 elastomer materials such as soft polyurethane or nitrile  
10 rubber. Other heat improving additives which have a smaller  
11 effect on the hardness of the final product may be used  
12 instead of carbon black, such as  $\text{Fe}_2\text{O}_3$  or alpha aluminum  
13 oxide.

14       Top layer 118 is preferably coated with a sub-micron  
15 layer of primer before being coated with additional layers. A  
16 preferred primer is Dow Corning 1205 Prime Coat. The type of  
17 primer depends on the properties of the top layer and of the  
18 conductive layer. Preferably, 0.3 micron of primer is coated  
19 onto a clean top layer with a No. 0 bar in a wire-rod coating  
20 apparatus and is allowed to dry before applying the conductive  
21 layer.

22       Conductive layer 115 is preferably formed of an acrylic  
23 rubber loaded with conductive carbon black. The conductive  
24 layer is formed by first compounding 300 grams of Hytemp  
25 4051EP (Zeon Chemicals) with 6 grams of Hytemp NPC 50 and 9  
26 grams of sodium stearate in a two-roll mill for 20 minutes;  
27 and then dissolving 150 grams of the compounded material in  
28 2000 grams of methyl ethyl ketone (MEK) by stirring for 12  
29 hours at room temperature.

30       48 grams of conductive carbon black, such as, for  
31 example, Printex XE2 (Degussa) are added to the solution and  
32 the mixture is ground in a 01 attritor (Union Process) loaded  
33 with 3/16" steel balls. Grinding proceeds at 10°C for 4 hours  
34 after which time the material is diluted by the addition of  
35 MEK to a concentration of 7.5-8% solids and discharged from  
36 the grinder in the form of a conductive lacquer.

37       This material is coated onto layer 118 to a thickness of  
38 preferably 1-3 micrometers.

1 In an alternate preferred embodiment of the invention,  
2 where a thicker conductive layer is desired for attachment to  
3 bar 108 by way of piercing elements, layer 118 is made  
4 conductive and layer 115 is omitted. For this embodiment a  
5 different conductive formulation is preferably used, which  
6 formulation is prepared as follows:

7 1) 100g of Hi-Temp 4051 EP (Zeon) acrylic resin and 15-25  
8 grams of Printex XE-2 carbon black (Degussa) are mixed on an  
9 unheated two-roll mill or Bumbury mixer for 2-4 minutes.

10 2) 2g NPC-50 crosslinker (Zeon) and 3g sodium stearate  
11 are added to the mixture on the two roll mill and mixing is  
12 continued for 4-10 minutes. The mill is kept cool to avoid  
13 premature polymerization of the acrylic resin.

14 3) The resulting mixture is dissolved and dispersed in  
15 toluene to give a mixture containing 17% to about 30% non-  
16 volatile solids.

17 4) The resultant mixture is progressively filtered, with  
18 a final filtering stage of 50 micrometers.

19 Layer 120 is overcoated with about 100 micrometers of the  
20 resulting material and is dried at up to 100°C for a few  
21 minutes. Several layers of this material are added until the  
22 desired thickness of 100 micrometers is reached. This layer is  
23 sized as described above. The resulting conductive layer  
24 preferably has a resistance of 15K ohms per square to 50K ohms  
25 per square.

26 An additional coating of primer may be added over the  
27 conductive lacquer or the conductive top layer 118 (except for  
28 the portion which is to be inserted into bar 108) before the  
29 remaining layers, i.e. the layers of image transfer portion  
30 104, are laminated onto blanket body 116. Conductive layer 115  
31 is preferably not cured until after lamination with portion  
32 104, as described below.

33 The resistance of the conductive layer should preferably  
34 be more than about 15-20K ohms per square and preferably less  
35 than about 50K ohms per square. This value will depend on the  
36 resistivity of the layers above the conducting layer and on  
37 the aspect ratio of the blanket. In general, the resistance  
38 should be low enough so that the current flowing on the

1 conducting layer (to supply leakage current through the  
2 overlying layers) does not cause a substantial variation of  
3 voltage along the surface of the blanket. The resistance of  
4 the conducting layer and, more importantly, the resistance of  
5 the overlying layers control the current flowing through the  
6 overlying layers. Generally speaking, the conductive layer has  
7 a relatively low resistance and resistivity, the conforming  
8 layer (layer 111) has a higher resistivity and the overlying  
9 release layer (layer 109) has a still higher resistivity.

10 As shown in Fig. 3, image transfer portion 104 is  
11 preferably formed on a carrier substrate 200 independently of  
12 the formation of blanket body 116 as described above. The  
13 utilized surface 202 of substrate 200 should be releasable  
14 from conforming layer 111, barrier layer 114 or conducting  
15 layer 115 (depending on whether barrier layer 114 and/or  
16 conductive layer 115 are included in image transfer portion  
17 104), because portion 104 is to be subsequently removed from  
18 substrate 200. Furthermore, the releasability of substrate 200  
19 from portion 104 should be higher than the releasability of  
20 release layer 109 from conforming layer 111, to ensure that  
21 the layers in portion 104 are collectively releasable from  
22 substrate 200. In a preferred embodiment of the invention,  
23 substrate 200 is a sheet of metalized, preferably aluminized,  
24 polyester having a thickness of between 100 micrometers and  
25 175 micrometers. This material provides substrate 200 with the  
26 desired release and support qualities. It should be  
27 appreciated, however, that other materials may be equally  
28 suitable or more suitable for providing the desired qualities  
29 of substrate 200.

30 Barrier layer 114 is preferably included in image  
31 transfer portion 104 in order to isolate the other layers in  
32 the image transfer portion from body portion 116, when  
33 transfer portion 104 is subsequently integrated with body  
34 portion 116, as described below. Such isolation may be  
35 required because blanket body 116 may contain materials such  
36 as anti-oxidants, anti-ozonants or other additives which may  
37 migrate through the upper layers of the blanket, for example  
38 as a gas when the blanket is heated during the imaging process

1 and/or in the presence of carrier liquid such as Isopar L. The  
2 barrier layer should be substantially impervious to such  
3 materials in the blanket body which may migrate and/or to the  
4 carrier liquid which is used by the imaging apparatus. If this  
5 layer is omitted, under certain circumstances the additive  
6 materials can cause deterioration of the photoreceptor used by  
7 the imaging apparatus. In particular, it was found that the  
8 imaging process may become humidity dependent.

9 In a preferred embodiment of the invention, a 4-11  
10 micrometer layer of polyvinyl alcohol (88% hydrolyzed) is  
11 coated onto surface 202 of substrate 200.

12 Polyvinyl alcohol, 88% hydrolyzed, having an average  
13 molecular weight preferably between 85,000 and 145,000  
14 (Aldrich Chemical Co. Inc., Milwaukee, WI) is dissolved in  
15 water at 90°C by continuously stirring the mixture in a reflux  
16 system for 30 minutes. After 30 minutes, a quantity of ethanol  
17 equal to twice the quantity of water is added to the solution,  
18 the resulting polyvinyl alcohol concentration being preferably  
19 less than 10%. Higher concentration solutions can be used;  
20 however, they give a more viscous solution which is hard to  
21 spread evenly.

22 The solution can be deposited on surface 202 of substrate  
23 200 using a fine wire rod or knife inclined at 30-45° to the  
24 direction of movement of the knife or body. The solvent is  
25 evaporated either by drying at room temperature or by blowing  
26 hot air on the layer.

27 One or more coating passes are employed to give the  
28 required thickness.

29 Too thin a layer will subsequently result in some  
30 penetration of material from body 116 into the layers of  
31 portion 104, which is correlated with reduced transfer  
32 efficiency from the photoreceptor to the intermediate transfer  
33 blanket. This reduced transfer efficiency is believed to be  
34 caused by photoreceptor deterioration. While four micrometers  
35 of material appears to be sufficient to avoid leaching, a  
36 somewhat thicker layer is preferably used.

37 Other barrier materials and other thicknesses may be used  
38 depending on the carrier liquid used for the toner or the

1 gasses omitted by body 116. Other barrier materials may  
2 require lesser or greater thickness depending on their  
3 resistance to the carrier liquid or the gasses released by  
4 body 116. Alternatively, if body 116 resists leaching by the  
5 carrier liquid or does not contain materials which are  
6 released (especially when body 116 is heated) or any anti-  
7 oxidants and/or anti-ozonants, layer 114 may be omitted.

8 In a preferred embodiment of the invention, barrier layer  
9 114 on substrate 200 is overcoated with soft, conforming,  
10 layer 111, formed of polyurethane or a material similar to the  
11 material of the very soft layer which is optionally used for  
12 layer 126, as described above. Layer 111 is formed by the  
13 following process, in accordance with a preferred embodiment  
14 of the invention:

15 One kg of pre-filtered Formez-50 polyester resin (Hagalil  
16 Company, Ashdod, Israel) is dehydrated and degassed under  
17 vacuum at 60°C. 600 grams of the degassed material is mixed  
18 with 1.4 grams of di-butyl-tin-diluarate (Aldrich) and  
19 degassed at room temperature for 2 hours. 30 grams of the  
20 resulting material, 3.15 grams of RTV Silicone 118 (General  
21 Electric) and 4.5 grams of Polyurethane cross-linker, DESMODUR  
22 44V20 (Bayer) are stirred together. A 100 micrometer layer of  
23 the material is coated over the preceding layer using a No. 3  
24 wire rod with one or several passes, under clean conditions,  
25 preferably, class 100 conditions. The coating may be cured for  
26 two hours at room temperature under a clean hood to form a  
27 polyurethane layer or may be cured later, together with other  
28 layers.

29 In accordance with a second preferred embodiment of the  
30 invention, layer 111 is formed by the following process:

31 1) 100g of Hi-Temp 4051 EP (Zeon) acrylic resin is mixed  
32 with 2g NPC-50 crosslinker (Zeon) and 3g sodium stearate and  
33 dissolved in toluene to give a solution of 15% non-volatile  
34 solids. Optionally, about 44g of carbon black Pearls 130  
35 (Cabot) is added.

36 2) A thin layer of the solution is coated onto the  
37 barrier layer and dried. This process is repeated several

1 times until a thickness of preferably 100 micrometers is  
2 achieved.

3       The layer has a Shore A hardness of about 20-24 without  
4 carbon black and about 42-45 with carbon black. Softer  
5 materials are also suitable; however, substantially harder  
6 materials do not adhere well to the drum surface. The acrylic  
7 material may be replaced by other soft elastomer materials  
8 such as soft nitrile rubber, as described in detail in PCT/NL  
9 95/00188, the disclosure of which is incorporated herein by  
10 reference.

11       Layer 111 which is thus formed should have a resistance  
12 of the order of about  $10^8$  ohm-cm, good thermal stability at  
13 the working temperature of the blanket surface, which is  
14 preferably about 100°C or less.

15       The function of the conforming layer is to provide good  
16 conformation of the blanket to the image forming surface (and  
17 the image on the image forming surface) at the low pressures  
18 used in transfer of the image from the image forming surface  
19 to the blanket. The layer should have a Shore A hardness  
20 preferably of between 25 and 65, more preferably between 40  
21 and 50, more preferably between about 42 and 45. While a  
22 thickness of 100 micrometers is preferred, other thicknesses,  
23 between 50 micrometers and 300 micrometers can be used, with  
24 75 to 125 micrometers being preferred. Too hard a layer can  
25 cause incomplete transfer to the intermediate transfer member  
26 of very small printed areas, such as single dots. Too soft a  
27 layer can cause difficulty in removal of a paper substrate (to  
28 which the image is transferred from the intermediate transfer  
29 member) from the intermediate transfer member. It is often  
30 difficult to achieve optimum transfer and substrate removal.

31       This problem is partially solved by dividing conforming  
32 layer 111 into a number of sub-layers of different hardnesses.  
33 The sub-layers may have the same thickness or different  
34 thicknesses. This embodiment is based on the discovery that  
35 paper removal appears to be most sensitive to the hardness of  
36 the upper portion of the layer and that transfer of the image  
37 to the transfer blanket is less sensitive to the hardness of  
38 this portion of the layer.

1 Such sub-layers of varying hardness and thickness may be  
2 formed in generally the same way as described above with  
3 respect to the second method of forming layer 111, with the  
4 hardness of the sub-layers being varied by changing the  
5 proportion of carbon black. The softer and harder sub-layers  
6 are laid down separately to form the total desired thickness  
7 of conforming layer 111.

8 It was found that varying the hardness of the harder  
9 layer between 42 and 55 Shore A, the soft layer hardness  
10 between 20 and 42 and the thickness of the harder layer  
11 between 15 and 30 micrometers (the total layer thickness  
12 remaining at 100 micrometers) gave improved paper release  
13 properties. The image transfer was improved mainly for the  
14 experiments in which the hard layer was thinner and the soft  
15 layer softer. The layers are preferably formed such that the  
16 harder layer is closest to the upper portion of the layer, and  
17 the softer layer closer to the body 116 of the intermediate  
18 transfer member. It is believed that thinner hard layers  
19 and/or softer soft layers will give even better results.

20 In a preferred embodiment of the invention, conforming  
21 layer 111 is overcoated with release layer 109, which is  
22 formed by the following process, according to one preferred  
23 embodiment of the invention. 12 grams of RTV silicone 236 (Dow  
24 Corning) release material preferably diluted with 2 grams of  
25 Isopar L (Exxon) and 0.72 grams of Syl-off 297 (Dow Corning)  
26 are mixed together. A wire rod (bar No. 1) coating system is  
27 used, with between one and six passes, under clean conditions  
28 to achieve a preferably 3-15 micrometer, more preferably 6-12  
29 and most preferably 8-10 micrometer release layer thickness.  
30 In practice the release layer is about 8 micrometers thick.  
31 The material is cured at room temperature for 2 hours followed  
32 by 140°C for two hours. The cured release material has a  
33 resistivity of approximately  $10^{14}$  to  $10^{15}$  ohm-cm (or a lesser  
34 value if a conductive material is added).

35 According to a second preferred embodiment of the  
36 invention, release layer 109 is formed of a condensation type  
37 silicone release layer. In general such materials are not used  
38 for thin layers, such as the approximately 3-15 micrometer,

1 preferably 8 micrometer layer generally desired for the  
2 present invention. However, it has been discovered that when a  
3 larger than normal amount of catalyst is added and when the  
4 material is preferably cured at an elevated temperature, such  
5 materials do cure, even in very thin layers. While generally  
6 0.1%-0.5% of catalyst is normally used, the present invention  
7 uses 0.5%-2.5% catalyst preferably greater than 1%. In the  
8 preferred embodiment given below, the amount of catalyst is  
9 about 2.5 times the maximum normally used.

10 It has been found that intermediate transfer members  
11 using such materials for release layer 109 have generally  
12 longer operating lifetime and generally better printing  
13 characteristics than blankets formed with release layers  
14 according to the prior art. This is also true of blankets in  
15 which the image transfer portion is formed directly onto the  
16 body as in the prior art. In a preferred embodiment of the  
17 invention only reactive silicone compounds are used in the  
18 formation of layer 109 with as small an amount of such  
19 compounds as silicone oils being present, less than 10%,  
20 preferably less than 5% and even more preferably less than 1%  
21 of silicone oils being present. Furthermore, it has been found  
22 that such materials are generally most useful when they have  
23 no fillers, less than 0.1%, or only a small amount of fillers,  
24 less than 4%.

25 Useful materials have been found to include  
26 diorganopolysiloxanes terminated at both chain ends with  
27 diorganohydroxysilyl groups bonded to terminal silicone atoms  
28 work especially well. Finally, it has been found that a  
29 mixture of such compounds gives better overall results than  
30 individual compounds.

31 In a preferred embodiment of the invention the release  
32 layer 109 is prepared by the following process:

33 a) 12 Grams of RTV 41 (general Electric) is mixed with 16  
34 grams of RTV 11 (General Electric) with the fillers removed  
35 (50% solids) and a 250 microliters of an 8:2 solution of  
36 Stannous octoate (Sigma) in Isopar H (EXXON).



1        b) The mixture is coated onto the conforming layer 111 of  
2 the blanket using a wire rod and is immediately introduced  
3 into an oven at 140°C for curing for two hours.

4        The filler material is preferably removed from RTV 11 by  
5 dissolving 120 gm of RTV 11 in 80 grams of an Isopar H/Hexane  
6 mixture (1:1). The solution is centrifuged at 7000 RPM for one  
7 hour.

8        The resulting material has about 25% filler material,  
9 comprising mostly calcium carbonate. A release layer with less  
10 filler can be prepared by removing the filler material from  
11 the RTV 41 as well.

12       It has been found that using the individual components of  
13 the mixture, namely RTV 41 and RTV 11 by themselves to form  
14 release layer 109 also gives an improvement over the prior  
15 art. However, the mixture appears to give a greater  
16 improvement.

17       According to a third preferred embodiment, a crosslinker,  
18 such as ethyl silicate and conductive material, such as carbon  
19 black or anti-static compounds such as CC-42 (Witco) are added  
20 to the release layer 109 of the second preferred embodiment of  
21 the invention. The added crosslinker provides for further  
22 improvement of the mechanical properties and very thin film  
23 polymerization of the release layer, while the added  
24 conductive material provides for improved electrical  
25 characteristics and print quality.

26       Primers, such as (3-glycidoxypropyl)trimethoxysilane  
27 (ABCR, Germany) and 1205 (Dow Corning), are used to provide  
28 for maximum adhesion of the release layer 109 to the  
29 conforming layer 111.

30       The release layer 109 of this embodiment is prepared as  
31 follows:

32       a) 100 gm RTV 11 (GE) are dissolved in 100 gm  
33 hexane/isopar-H (50:50 by wt.) mixture, 100 gm RTV 41 (GE) are  
34 dissolved in 100 gm hexane/isopar-H mixture, and both mixtures  
35 are centrifuged at 7000 RPM for 70 min. The liquid is  
36 decanted, percent solids determined, and the precipitated  
37 solids, comprising filler material, in this case calcium  
38 carbonate, from the centrifugation is discarded.

1        b) An amount of RTV 11 solution which provides 60 gm RTV  
2 11 solids is mixed with an amount of RTV 41 solution which  
3 provides 40 gm RTV 41 solids. To this mixture is added 5 gm  
4 ethyl silicate (Chordip) and 1 gm Ketjenblack 600 carbon black  
5 (Akzo). The mixture is dispersed with a high shear mixer for  
6 10 min.

7        c) Before the conforming layer 111 of the ITM is coated  
8 with the silicone release layer 109, the conforming layer 111  
9 must be coated with the appropriate primers to provide maximum  
10 adhesion. Using acrylic rubber as the soft layer of the  
11 conforming layer 111, it is first coated with a thin layer of  
12 (3-glycidoxypropyl)trimethoxysilane (ABCR, Germany). The  
13 primer coated blanket is heated at 50 °C for 5 min. The first  
14 primer layer is then coated with a second primer layer of 1205  
15 (Dow Corning), and is left at room temperature for 15 min.

16        d) To 10 gm of the above-described release material is  
17 added 350 microliters of a stannous octoate/isopar-H mixture  
18 (4:1 by weight). A dry film thickness of about 7 microns is  
19 achieved by 2-3 coatings with a wire rod. Immediately after  
20 coating the transfer-portion carrying substrate 104 with the  
21 release layer 109, it is placed in an oven at 140 °C for two  
22 hours.

23        Once the formation of image transfer portion 104 on  
24 substrate 200 is complete, the transfer-portion carrying  
25 substrate is fed to blanket-forming apparatus 180 along the  
26 direction indicated by arrow 205. An edge of transfer portion  
27 104 is separated from surface 202 of substrate 200 and  
28 collected by a carrier drum 220, which preferably includes a  
29 drum having a smooth, preferably metal, surface 222. Surface  
30 222 is preferably formed of very smooth, chrome-coated,  
31 stainless steel. Drum 220 preferably rotates in the direction  
32 indicated by arrow 210, at a suitable rate, such that surface  
33 222 moves substantially at the same linear velocity as  
34 substrate 200.

35        As shown in Fig. 3, release layer 109 is the upper-most  
36 layer coated onto surface 202 of substrate 200 and, thus,  
37 layer 109 interfaces surface 222 of drum 220. The generally  
38 smooth release layer 109 will temporarily attach itself by a

1 vacuum action to the smooth, metal, surface 222 of drum 220,  
2 thereby assisting in the transfer of portion 104 from  
3 substrate 200 to intermediate carrier 220, at a first transfer  
4 region 203.

5 As further shown in Fig. 3, the pre-fabricated body  
6 portion 116 is fed into a second transfer region 206, between  
7 intermediate carrier drum 220 and a lamination drum 212 having  
8 a surface 214, along the direction indicated by arrow 215.  
9 Drum 212 rotates in a sense opposite that of drum 220, as  
10 indicated by arrow 217, such that there is substantially zero  
11 relative motion between surfaces 222 and 214 at region 206.

12 At second transfer region 206, image transfer portion 104  
13 attaches itself to portion 116 and is thus removed from  
14 surface 222 of drum 220. Portion 104 is laminated with body  
15 portion 116, resulting in the formation of the integrated,  
16 multi-layered, image transfer blanket 100.

17 Lamination of the two portions of blanket 100 is  
18 preferably aided by heat and pressure applied by drums 220 and  
19 212. In a preferred embodiment of the invention, drum 220 is  
20 heated to a temperature range of between 90°C and 130°C.  
21 Additionally, drum 212 may also be heated. This temperature  
22 range should be suitable for aiding bonding between transfer  
23 portion 104 and body portion 116, when the materials described  
24 above are used. Bonding is achieved by the uncured conductive  
25 layer 115 which becomes highly adhesive in response to the  
26 heat applied thereto during lamination.

27 As mentioned above, conductive layer 115 is preferably  
28 not cured prior to lamination. However, the layers in transfer  
29 portion 104, i.e. layers 109, 111 and 114, may be cured before  
30 lamination, if the conductive layer is formed as part of body  
31 portion 116, prior to lamination, as described above.  
32 Nevertheless, if conductive layer 115 is included is formed as  
33 part of image transfer portion 104, prior to lamination, all  
34 the layers in portion 104 are preferably not cured before  
35 lamination.

36 If layer 118 is made conductive (and layer 115 is  
37 omitted) then a thin layer of the lacquer of the type used for

1 layer 115 or a glue or a primer may be used over layer 118 to  
2 enhance the lamination process.

3       Once portions 104 and 116 are laminated, the blanket is  
4 cured, for example, using a curing device 225. The cured  
5 layers include the layers which were not cured prior to  
6 lamination, particularly conductive layer 115 and, optionally,  
7 uncured layers in image transfer portion 104. Curing device  
8 225 preferably includes a heater as is well known in the art.  
9 This completes the formation of multi-layered image transfer  
10 blanket 100. Alternatively, strips of blanket may be cured in  
11 an oven heated to between 110°C (for about one hour) and 180°C  
12 (for about four minutes).

13       Reference is now made to Fig. 4 which schematically  
14 illustrates a cross-section of an image transfer blanket 300  
15 having a body portion 216 and an image transfer portion 204,  
16 constructed in accordance with another, preferred, embodiment  
17 of the present invention. Blanket 300 preferably includes all  
18 of the layers described above with reference to Figs. 1-3,  
19 i.e. layers 109, 111, 115, 118, 120, 122 and, optionally,  
20 adhesive (or soft) layer 126 of blanket 100 (Fig. 2C).  
21 However, in contrast to the integrated blanket 100, image  
22 transfer portion 204 of blanket 300 is a self-supporting layer  
23 which is not necessarily laminated with body portion 216.  
24 Image transfer portion 204 may be permanently or removably  
25 attached to body portion 216, using a suitable adhesive, or  
26 portion 204 may be used in conjunction with body portion 216  
27 without being attached thereto, for example, as described in  
28 detail below. To obtain these features of blanket 300, the  
29 active layers of image transfer portion 204 are preferably  
30 formed on a thin (including at least the range of 30  
31 micrometers to preferably less than 12 micrometers, with  
32 physical stability defining the lower limit of the range)  
33 intermediate base layer 250, which is formed of a relatively  
34 non-compliant material such as Kapton. Base layer 250 does not  
35 contaminate the other layers in transfer portion 204, during  
36 formation thereof, and has sufficient strength to support the  
37 other layers in portion 204. However, base layer 250 does not  
38 obviate the need for body portion 216 which provides, inter

1 alia, high pressure resilience required by multi-layered  
2 blanket 300. It is believed that base layer 250 does

3 not substantially affect the operation of body portion 216.

4 It should be noted that failure of intermediate transfer  
5 blankets is caused primarily by failure of the release  
6 properties of layer 109. Although, eventually, failure of the  
7 blanket may also be caused by failure of the resilient  
8 properties of body portion 116, the resilient properties of  
9 the body portion last much longer, at least several times  
10 longer, than the release properties of the release layer.  
11 Thus, the present invention provides a mechanism for replacing  
12 only the image transfer portion of blanket 300, as described  
13 below.

14 Reference is now made to Fig. 5 which schematically  
15 illustrates an image transfer member 230 using an image  
16 transfer blanket, such as blanket 300 of Fig. 4, in which  
17 transfer portion 204 is separate from body portion 216. Body  
18 portion 216 of blanket 300 is mounted on a drum 240 which  
19 rotates in the direction indicated by arrow 235. Body portion  
20 216 may be mounted in a manner similar to that of blanket 100  
21 in the embodiment of Fig. 1, such that only one end of the  
22 body portion is secured to a fastener member (not shown) which  
23 would be situated at the location indicated by reference  
24 numeral 310.

25 In accordance with the present invention, image transfer  
26 member 230 further includes apparatus for replacing image  
27 transfer portion 204 of image transfer blanket 300 without  
28 replacing body portion 216. The replacement apparatus  
29 preferably includes a transfer portion supply member 260,  
30 preferably a cassette containing a predetermined length of  
31 new, i.e. unused, transfer portion 204, and a take up member  
32 270, preferably a cassette, which collects used transfer  
33 portion 204. Transfer portion 204 is preferably tightly  
34 stretched over body portion 216, between an aperture 265 of  
35 supply member 260 and an aperture 275 of take-up member 270.  
36 To ensure that a suitable tension is maintained in transfer  
37 portion 204, the transfer portion is preferably locked and/or  
38 tensioned at apertures 265 and 275 using any suitable

1 lock/tension devices (not shown), preferably electrically  
2 controlled devices. Alternatively, a take-up roller 227 and a  
3 pay-out roller 278 are tensioned to assure desired tension in  
4 the exposed part of portion 204.

5 In a preferred embodiment of the invention, take-up  
6 member includes a motor-operated take-up roller 277 which  
7 collects the used transfer portion 204. Preferably, upon  
8 command from a controller (not shown), a predetermined length  
9 of transfer portion 204 is collected by take-up roller 277, so  
10 as to replace the transfer portion on the entire surface of  
11 body portion 216. The controller preferably also controls  
12 deactivation of the lock/tension devices at apertures 265 and  
13 275, before replacement of the transfer portion, and  
14 reactivation of the lock/tension devices upon completion of  
15 the replacement process.

16 It should be noted that portion 204 is much thinner than  
17 body portion 216 and, thus, a longer length of transfer  
18 portion may be contained in supply member 260, in comparison  
19 to prior art mechanisms which replaced the entire thickness of  
20 the blanket. This enables a larger number of replacements of  
21 portion 204 before the entire supply of transfer portion 204  
22 in member 260 is used.

23 Other details of preferred imaging apparatus used in  
24 conjunction with the present invention are described in PCT/NL  
25 95/00188, the disclosure of which is incorporated herein by  
26 reference.

27 It should be understood that some aspects of the inven-  
28 tion are not limited to the specific type of image forming  
29 system used and some aspects of the present invention are also  
30 useful with any suitable imaging system which forms a liquid  
31 toner image on an image forming surface and, for some aspects  
32 of the invention, with powder toner systems. Some aspects of  
33 the invention are also useful in systems such as those using  
34 other types of intermediate transfer members such as belt or  
35 continuous coated drum type transfer members. Some aspects of  
36 the invention are suitable for use with offset printing  
37 systems. The specific details given above (and in the  
38 documents incorporated herein by reference) for the image

1 forming system are included as part of a best mode of carrying  
2 out the invention; however, many aspects of the invention are  
3 applicable to a wide range of systems as known in the art for  
4 electrophotographic and offset printing and copying.

5       It will be appreciated by persons skilled in the art that  
6 the present invention is not limited by the description and  
7 example provided hereinabove. Rather, the scope of this  
8 invention is defined only by the claims which follow:

CLAIMS

- 1  
2 1. A method of producing a multi-layered image transfer  
3 blanket including a body portion and an image transfer  
4 portion, the image transfer portion having an image transfer  
5 surface and a back surface, comprising:  
6 forming the image transfer portion on a carrier  
7 substrate; and  
8 transferring the image transfer portion onto the body  
9 portion such that the back surface of the image transfer  
10 portion faces the body portion.  
11
- 12 2. A method according to claim 1 wherein the image transfer  
13 portion is formed on the carrier substrate such that the back  
14 surface of the image transfer portion faces the carrier  
15 substrate.  
16
- 17 3. A method according to claim 1 or claim 2 wherein  
18 transferring the image transfer portion comprises:  
19 transferring the image transfer portion to a moving  
20 carrier surface, such that at least a portion of the image  
21 transfer surface is in contact with the moving surface; and  
22 laminating the image transfer portion onto the body  
23 portion such that the back surface of the image transfer  
24 portion faces the body portion.  
25
- 26 4. A method according to any of the preceding claims and  
27 further comprising curing at least one of the layers in said  
28 multi-layered blanket after transferring the image transfer  
29 portion.  
30
- 31 5. A method according to claim 4 wherein the image transfer  
32 blanket comprises a polymer layer interfacing the back surface  
33 of the image transfer portion and wherein curing at least one  
34 of the layers comprises curing the polymer layer after  
35 laminating the image transfer portion onto the body portion.  
36
- 37 6. A method according to claim 5 wherein the polymer layer  
38 is a conductive layer.



- 1  
2 7. A method according to claim 5 or claim 6 wherein the  
3 polymer layer is part of the body portion.  
4
- 5 8. A method according to claim 5 or claim 6 wherein the  
6 polymer layer is part of the image transfer portion.  
7
- 8 9. A method according to any of claims 4-7 wherein the image  
9 transfer portion comprises a release layer at the image  
10 transfer surface and a conforming layer and wherein curing at  
11 least one layer comprises curing the release layer and the  
12 conforming layer before laminating the image transfer portion  
13 to the body portion.  
14
- 15 10. A method according to any of claims 4-8 wherein the image  
16 transfer portion comprises a release layer at the image  
17 transfer surface and a conforming layer and wherein curing at  
18 least one layer comprises curing the release layer and the  
19 conforming layer after laminating the image transfer portion  
20 to the body portion.  
21
- 22 11. A method according to any of the preceding claims wherein  
23 forming the image transfer portion comprises:  
24 coating the carrier substrate with a conforming layer.  
25
- 26 12. A method according to any of claims 1-10 wherein forming  
27 the image transfer portion comprises:  
28 coating the carrier substrate with a barrier layer.  
29
- 30 13. A method according to any of claims 1-10 wherein forming  
31 the image transfer portion comprises:  
32 coating the carrier substrate with a conductive layer.  
33
- 34 14. A method according to claim 13 wherein forming the image  
35 transfer portion comprises:  
36 coating the conductive layer with a barrier layer.  
37

- 1 15. A method according to claim 12 or claim 14 wherein  
2 forming the image transfer portion comprises:  
3 coating the barrier layer with a conforming layer.
- 4 16. A method according to claim 14 wherein forming the image  
5 transfer portion comprises:  
6 coating the barrier layer with a conductive layer.
- 7
- 8 17. A method according to claim 13 or claim 16 wherein  
9 forming the image transfer portion comprises:  
10 coating the conductive layer with a conforming layer.
- 11
- 12 18. A method according to any of claims 9-11, 15 or 17  
13 wherein the conforming layer comprises a plurality of layers  
14 of different hardnesses.
- 15
- 16 19. A method according to any of claims 11, 15, 17, or 18  
17 wherein forming the image transfer portion comprises:  
18 overcoating the conforming layer with a release layer.
- 19
- 20 20. A method according to any of the preceding claims wherein  
21 the release layer comprises a layer of condensation type  
22 silicone.
- 23
- 24 21. A method according to claim 20 wherein the condensation  
25 type silicone contains less than 4% filler material.
- 26
- 27 22. A method according to claim 20 wherein the condensation  
28 type silicone contains less than 1% filler material.
- 29
- 30 23. A method according to claim 20 wherein the condensation  
31 type silicone contains less than 0.1% filler material.
- 32
- 33 24. A method according to any of claims 20-23 wherein the  
34 release layer has a thickness of less than 1 mm.
- 35
- 36 25. A method according to any of claims 20-23 wherein the  
37 release layer is less than 200 micrometers thick.
- 38

1 26. A method according to any of claims 20-23 wherein the  
2 release layer is less than 100 micrometers thick.

3  
4 27. A method according to any of claims 20-23 wherein the  
5 layer is less than 50 micrometers thick.

6  
7 28. A method according to any of claims 20-23 wherein the  
8 layer is between about 3 and about 15 micrometers thick.

9  
10 29. An image transfer member suitable for the transfer of  
11 toner images and having an outer release layer of a  
12 condensation type silicone.

13  
14 30. An image transfer member according to claim 29 wherein  
15 the layer has a thickness of less than 1 mm.

16  
17 31. An image transfer member according to claim 29 wherein  
18 the layer is less than 200 micrometers thick.

19  
20 32. An image transfer member according to claim 29 wherein  
21 the layer is less than 100 micrometers thick.

22  
23 33. An image transfer member according to claim 29 wherein  
24 the layer is less than 50 micrometers thick.

25  
26 34. An image transfer member according to claim 29 wherein  
27 the layer is between about 3 and about 15 micrometers thick.

28  
29 35. An image transfer member according to any of claims 29 to  
30 34 wherein the outer release layer contains less than 10%  
31 silicone oil.

32  
33 36. An image transfer member according to any of claims 29 to  
34 34 wherein the outer release layer contains less than 5%  
35 silicone oil.

36

1 37. An image transfer member according to any of claims 29 to  
2 34 wherein the outer release layer contains less than 1%  
3 silicone oil.

4

5 37. An image transfer member according to any of claims 29 to  
6 34 wherein the outer release layer contains essentially no  
7 silicone oil.

8

9 38. A method according to any of claims 29 to 37 wherein the  
10 condensation type silicone contains less than 4% filler  
11 material.

12

13 39. A method according to any of claims 29 to 37 wherein the  
14 condensation type silicone contains less than 1% filler  
15 material.

16

17 40. A method according to any of claims 29 to 37 wherein the  
18 condensation type silicone contains less than 0.1% filler  
19 material.

20

21 41. An image transfer member according to any of claims 29 to  
22 40 wherein the outer release layer contains added crosslinker.

23

24 42. An image transfer member according to any of claims 29 to  
25 41 wherein the outer release layer contains added catalyst.

26

27 43. An image transfer member according to any of claims 29 to  
28 42 wherein the outer release layer contains added conductive  
29 material.

30

31 44. An image transfer member according to any of claims 29 to  
32 43 wherein adhesion of the outer release layer to the image  
33 transfer member is enhanced utilizing primer.

34

35 45. Apparatus for producing a multi-layered image transfer  
36 blanket including a body portion and an image transfer  
37 portion, the image transfer portion having an image transfer  
38 surface and a back surface, comprising:

1 a carrier substrate having the image transfer portion  
2 formed thereon such that the back surface of the image  
3 transfer portion faces the carrier substrate and is releasable  
4 therefrom; and

5 a moving carrier surface, in contact with a portion of  
6 the image transfer surface, which receives the image transfer  
7 portion from the carrier substrate, at a first transfer  
8 region, and laminates the image transfer portion onto the body  
9 portion, at a second transfer region, with the back surface of  
10 the image transfer portion facing the body portion.

11

12 46. Apparatus according to claim 45 and further comprising a  
13 curing device which cures at least one of the layers in said  
14 multi-layered blanket.

15

16 47. An image transfer blanket comprising:

17 a transfer surface adapted to receive already formed  
18 images; and

19 a conforming layer substantially immediately beneath the  
20 release surface which comprises a plurality of sub-layers each  
21 having a Shore A hardness of less than 80.

22

23 48. An image transfer blanket according to claim 47 wherein  
24 the sub-layers each have a shore A hardness of less than 70.

25

26 49. An image transfer blanket according to claim 47 wherein  
27 the sub-layers each have a shore A hardness of less than 60.

28

29 50. An image transfer blanket according to any of claims 47-  
30 49 wherein the sub-layers comprise at least two sub-layers, a  
31 relatively harder one of said sub-layers being situated  
32 between the release surface and a relatively softer one of  
33 said sub-layers.

34

35 51. An image transfer blanket according to claim 50 wherein  
36 the relatively softer sub-layer has a Shore A hardness of less  
37 than 42.

38

1 52. An image transfer blanket according to claim 50 wherein  
2 the relatively softer sub-layer has a Shore A hardness of less  
3 than 35.

4

5 53. An image transfer blanket according to claim 50 wherein  
6 the relatively softer sub-layer has a Shore A hardness of less  
7 than 25.

8

9 54. An image transfer blanket according to any of claims 50  
10 to 53 wherein the relatively harder sub-layer has a Shore A  
11 hardness of greater than 42.

12

13 55. An image transfer blanket according to any of claims 50  
14 to 53 wherein the relatively harder sub-layer has a Shore A  
15 hardness of greater than 50.

16

17 56. An image transfer blanket according to any of claims 50  
18 to 55 wherein the ratio of thickness of the relatively hard  
19 sub-layer to the thickness of the relatively softer sub-layer  
20 is about 1:4.

21

22 57. An image transfer blanket comprising:

23 a body portion including a layer of resilient material;  
24 and

25 a multi-layered transfer portion having an image transfer  
26 surface and including a supporting base layer which is formed  
27 of a substantially non-compliant material,

28 wherein the supporting base layer of the transfer portion  
29 interfaces the body portion.

30

31 58. An image transfer blanket according to claim 57 wherein  
32 the supporting base layer comprises a layer of Kapton.

33

34 59. A method of producing a multi-layered image transfer  
35 blanket comprising:

36 forming a multi-layered image transfer portion having an  
37 image transfer surface and a supporting base layer, the base

1 layer being formed of a substantially non-compliant material;  
2 and

3       attaching the image transfer portion to a body portion  
4 including a layer of substantially resilient material,  
5       wherein the supporting base layer of the transfer portion  
6 interfaces the body portion.

7  
8 60. An intermediate transfer member, which receives a toner  
9 image from an imaging surface and from which it is  
10 subsequently transferred, comprising:

11       a drum; and  
12       an image transfer blanket mounted on the drum, the image  
13 transfer blanket comprising:  
14           a body portion including a layer of resilient  
15       material; and  
16           a multi-layered transfer portion having an image  
17       transfer surface which receives the toner image and a  
18       supporting base layer which is formed of a substantially  
19       non-compliant material,  
20       wherein the supporting base layer of the transfer portion  
21 interfaces the body portion.

22  
23 61. An intermediate transfer member according to claim 60  
24 wherein the supporting base layer comprises a layer of Kapton.

25  
26 62. An intermediate transfer member, which receives a toner  
27 image from an imaging surface and from which it is subse-  
28 quently transferred, comprising:

29       a drum;  
30       a resilient blanket body mounted circumferentially on the  
31 surface of the drum and having a functional length;  
32       a sheet of image transfer material having first and  
33 second ends and having a length equal to at least twice the  
34 functional length of the blanket body;  
35       a transfer material supply member associated with the  
36 first end of the sheet; and  
37       a transfer material take-up member associated with the  
38 second end of the sheet,

1 wherein an appropriate length of the sheet is stretched  
2 between the supply member and the take-up member, over the  
3 functional length of the blanket body.

4

5 63. An intermediate transfer member according to claim 62  
6 wherein a predetermined length of used-up sheet is taken-up by  
7 the take-up member and replaced with approximately the same  
8 length of unused sheet which is supplied the supply member.

9

10 64. A carrier substrate having formed thereon a multi-layered  
11 image transfer arrangement, the image transfer arrangement  
12 comprising a back surface and an image transfer surface,  
13 wherein the back surface of the image transfer arrangement  
14 faces the carrier substrate and is removably attached thereto.



1/4

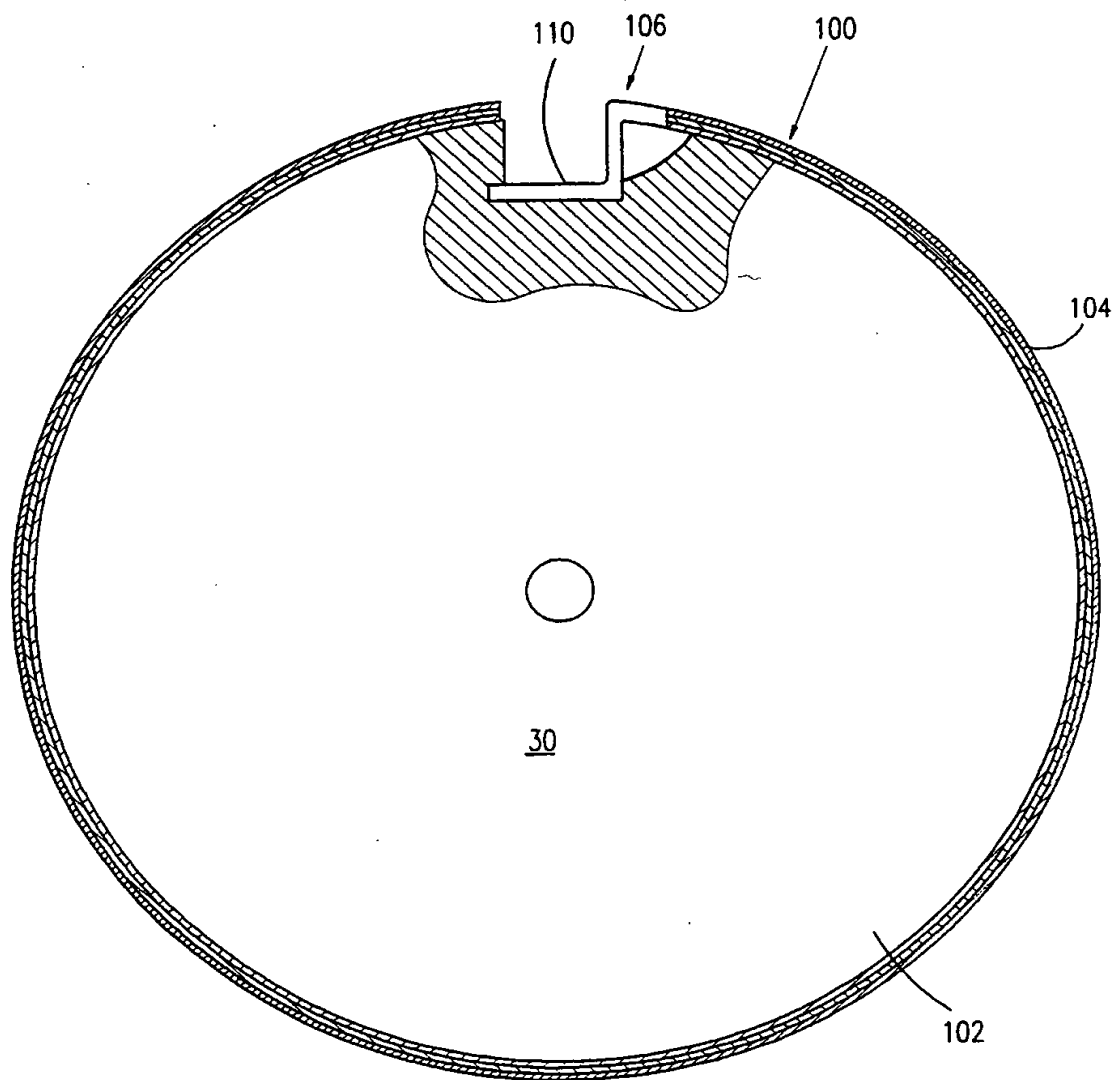


FIG. 1

2/4

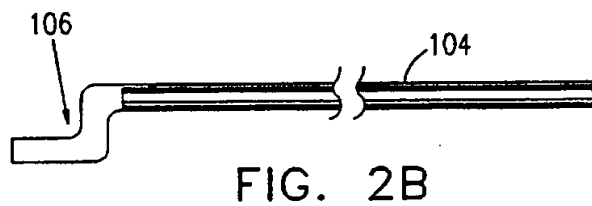
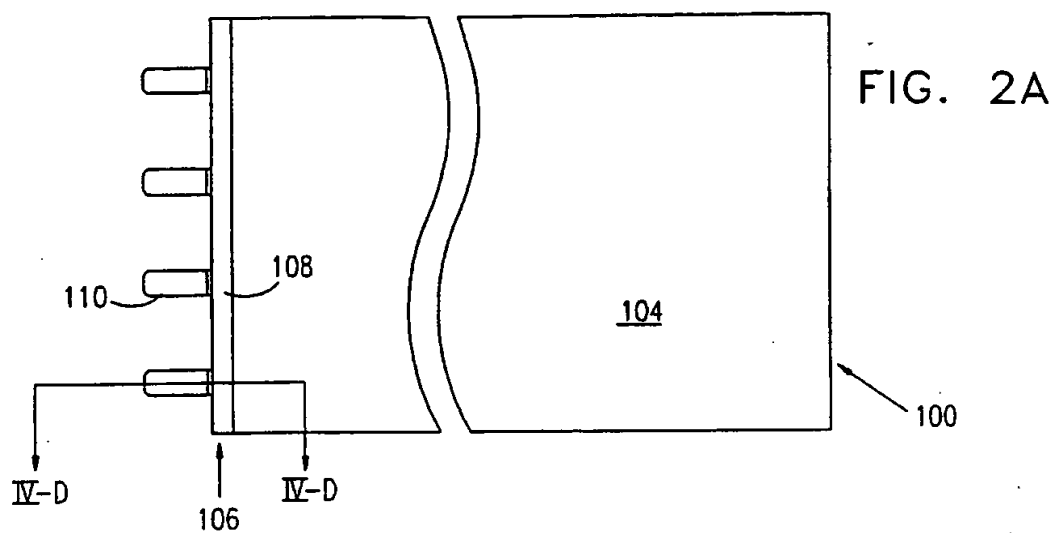
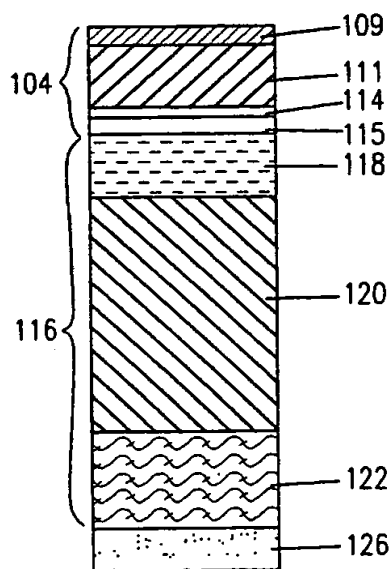
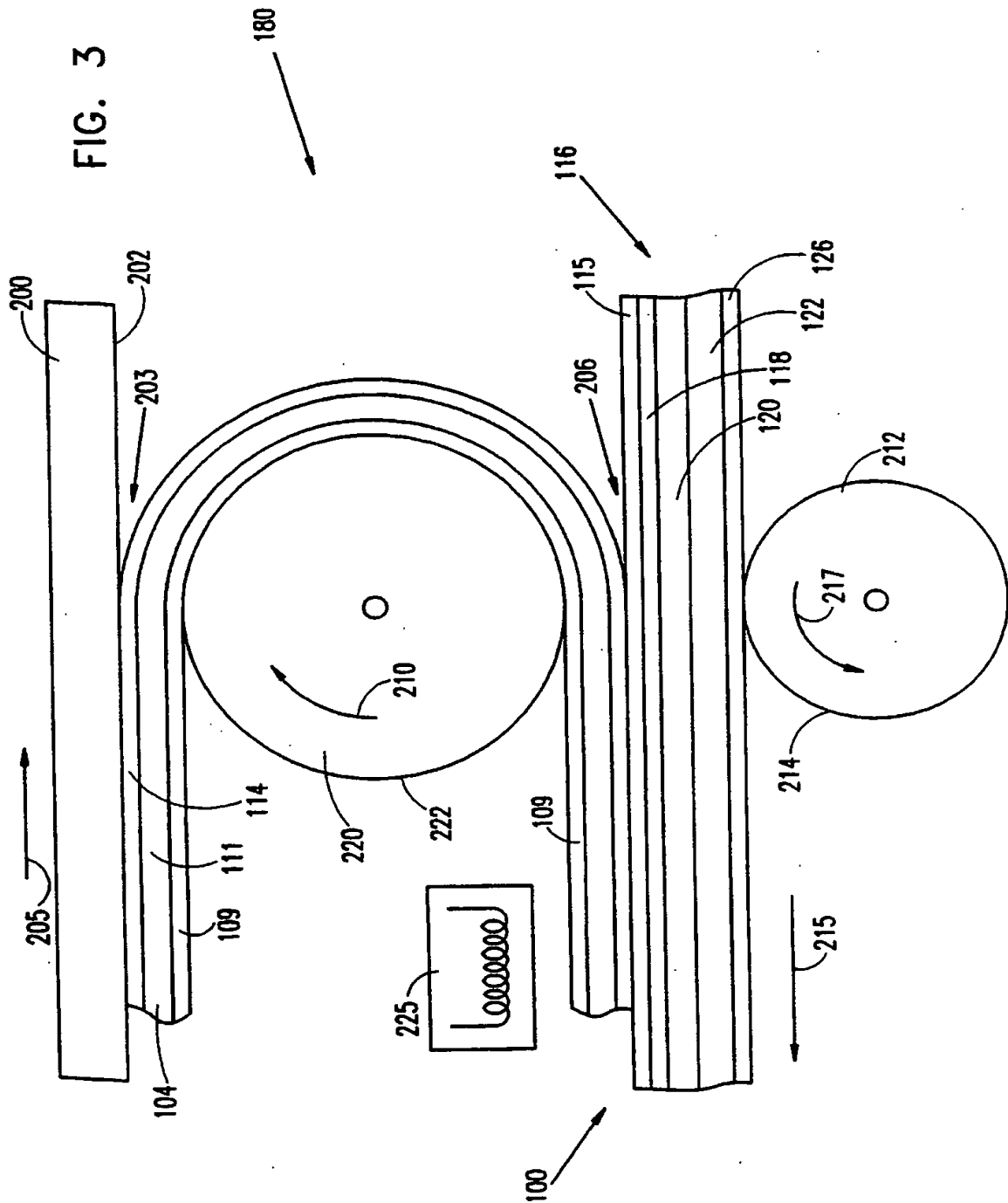


FIG. 2C



**FIG. 3**



4/4

FIG. 4

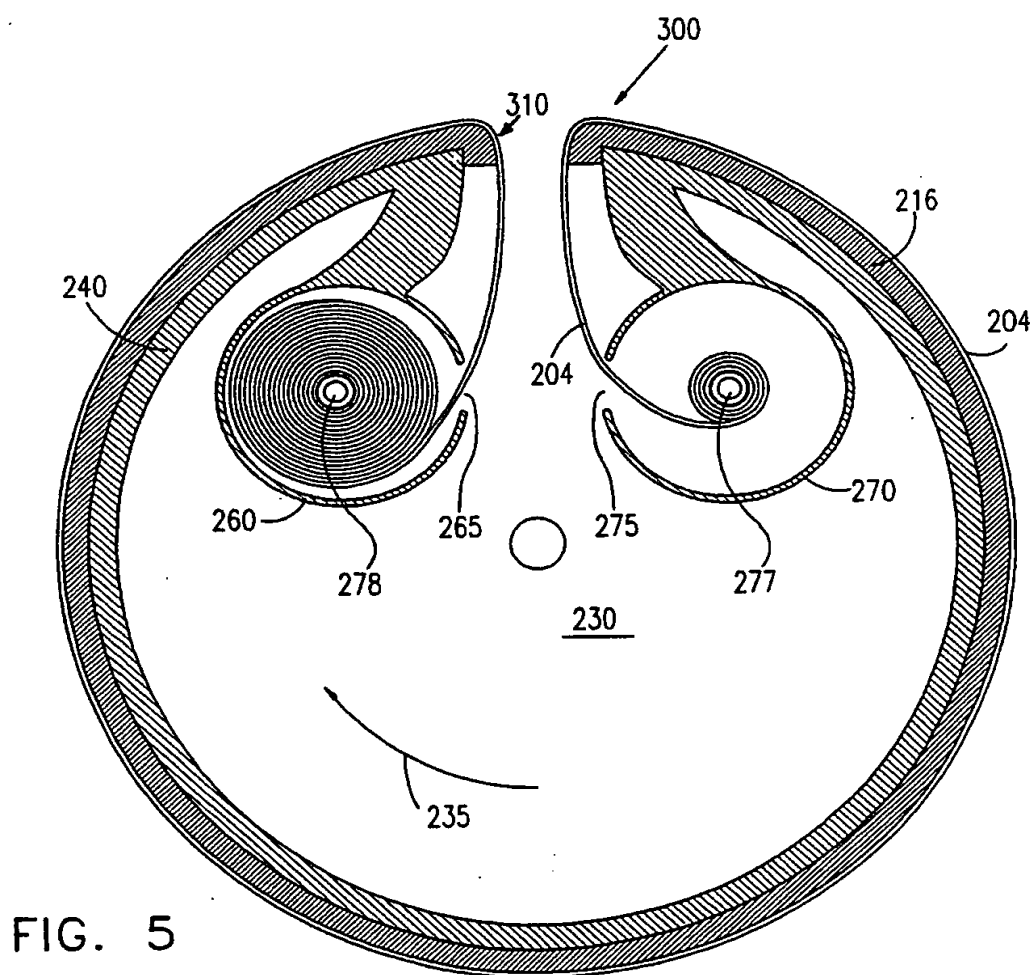
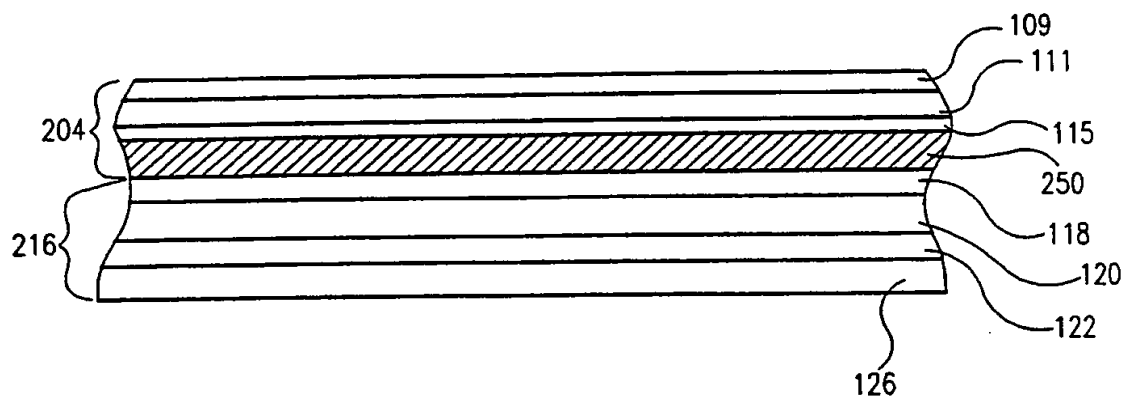


FIG. 5